# Public Interest Research and Development In the Electric and Gas Utility Industries

**The Electric Industry Restructuring Series**

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January 1998

# The Electric Industry Restructuring Series

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ISBN 1-55516-915-5

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# Preface

The material in this report was prepared in conjunction with the *Executive Dialog on Public Purpose Research and Development in the Electric and Gas Utility Industries*, convened in St. Louis, Missouri, on October 14-15, 1997. The National Association of Regulatory Utility Commissioners (NARUC) organized the dialog to address concerns that restructuring in the electricity and gas utility Industries might seriously compromise public interest research and development (R&D). The dialog was sponsored by NARUC, the National Council on Competition and the Electric Industry (National Council), the Electric Power Research Institute (EPRI), the Gas Research Institute (GRI), the Edison Electric Institute (EEI), the U. S. Department of Energy (DOE), the Association of State Energy and Research and Technology Transfer Institutions (ASERTTI) and the National Regulatory Research Institute (NRRI).

The National Council prepared a discussion paper for the dialog entitled *Strategic Options for Public interest Energy R&D*. It appears with minor revisions as section 2 of this report. Carl Blumstein and Stephen Wiel were the principal authors of this discussion paper, which was prepared under the guidance of Montana Public Service Commissioner Bob Anderson, chair of the R&D Dialog Planning Committee. The discussion paper also benefited from comments and suggestions from members of the planning committee, especially Mark Hanson of the Energy Center of Wisconsin, Al Pak and Hank Courtright of the Electric Power Research Institute, Diane Pirkey of the US Department of Energy, Bob Tindall of the Federal Energy Regulatory Commission, and Tina Thomas of the Gas Research Institute. Tom Tanton of the California Energy Commission, Jim Cole of the California Institute for Energy Efficiency, Scott Samuelsen of U.C. Irvine, Bill Valentino of the New York State Energy Research and Development Authority, and Jack White of UTECH also provided helpful comments.

The discussion paper served as a starting point for a dialog among the 115 attendees, which took place during three concurrent breakout sessions on October 15, 1997. Energetics Incorporated organized and facilitated these breakout sessions. Its summary of the results of the breakout sessions appears as section 3 of this report. Richard Scheer was the principal author of the breakout summary, which also benefited from contributions by Joe Badin, Jennifer Bergman, Jan Brinch, Audrey Lamanna, and Jennifer Schilling.

The assistance that we received is greatly appreciated, but readers should note that it does not constitute an endorsement of the report either by those who assisted us or by the organizations that employ them. The opinions expressed here, together with any errors and omissions that may remain, are solely the responsibility of the authors.

The report was prepared and published by the National Council with support from DOE via funding to NARUC and the Lawrence Berkeley National Laboratory. The National Council is a joint venture of NARUC and the National Conference of State Legislatures (NCSL), with participation by the Federal Energy Regulatory Agency (FERC). Copies of this report are downloadable from the National Council's web site (http://EandE.lbl.gov/NationalCouncil/) or from NARUC (phone: 202/898-2210 or e-mail: naruc@erols.com).

# Acknowledgments

For the past seven months, the authors have worked with public utility regulatory commissions and other stakeholders in New England to develop a uniform regional approach to consumer information disclosure. Our efforts and this report are part of the National Council on Competition and the Electric Industry's Consumer Information Disclosure Project. These activities are funded primarily by the U.S. Department of Energy and the U.S. Environmental Protection Agency.

This report benefited from the work and the insights of many people. Our largest debt is to the stakeholders (listed in appendix A) who attended the meetings and who, through their comments, helped improve this report immeasurably. We also wish to thank Jonathan Raab of Raab Associates Ltd., the facilitator for the disclosure meetings and who wrote the description of them, and Gillian Wright of EPA, who assisted with the section addressing emissions.

Naturally, the views expressed in this report and any errors are attributable to the authors, not to those of any funder or those who have been kind enough to offer assistance.

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# Executive Summary

The restructuring of the electricity industry has been accompanied by a sharp decline in research and development (R&D) expenditures by investor-owned utilities (IOUS). By 1996, IOU expenditures for research, development and demonstration (RD&D) had fallen by more than 45 percent from their peak in 1993. The questions for policymakers who are concerned with restructuring are (1) how will this decline affect the public interest, and (2) if some of the effects are adverse to the public interest, what mitigating steps, if any, should be taken?

Technological change is an important contributor to economic growth and R&D is an important contributor to technological change. Any sharp decline in R&D expenditures is, at the least, a cause for concern. On the other hand, restructuring is moving the business of electricity generation decisively toward competition. If history is a guide, this competition will be conducive to innovation. New R&D investments may be forthcoming from the competitors or their suppliers. Thus, concern with the current decline in R&D expenditures should focus on the R&D, if any, that will not be adequately provided by the competitive market.

## The Executive Dialog

To address R&D policy issues raised by restructuring in both the electricity and natural gas Industries, an *Executive Dialog on Public Purpose Research and Development in the Electric and Gas Utility Industries* was convened on October 14-15, 1997, in St. Louis, Missouri. This report contains both material that was prepared for the dialog and some results from the dialog. The two-day meeting involved a series of presentations by experts and three breakout sessions. To help frame the discussions in the breakout sessions, the National Council prepared a discussion paper entitled *Strategic Options for Public interest Energy R&D*. This discussion paper appears with minor revisions as section 2 of this report.

## What Is Public-Interest R&D?

The discussion paper on strategic options suggests a short definition of public interest R&D: *R&D that is not adequately provided by the competitive market since some or all of its benefits are widely distributed and cannot be captured by individual companies*. Among the areas where the benefits of Public interest R&D may be important are health, safety, environment, energy efficiency and "pre-commercial" technical information. Many R&D projects have both private and public benefits. The discussion paper uses examples to clarify what kinds of R&D might be classified as Public interest R&D. The examples, presented roughly in order of increasing private benefit relative to public benefit, range from fundamental studies of combustion to the development of new processes for wood pulping. In some of the examples the classification of a project as Public interest R&D is subjective, depending upon how one judges the balance between public benefits and incentives for private investment. The R&D described in each of the examples has received substantial utility funding, with the costs usually passed to ratepayers. Thus, the examples also provide an illustration of what may be lost if utility funding for public interest R&D collapses or sharply diminishes.

## The Issues

The discussion paper framed the strategic options for dealing with public interest energy R&D in terms of three broad topics: funding, governance and scope.

### Funding

Assuming that some body of R&D can be identified as unsupported by the market and that the benefits of pursuing this R&D should not be foregone, issues arise about how to pay for this R&D. These issues concern how much funding should be provided and by what mechanisms this funding should be collected.

Concerning how much, there is no consensus. The debate in California illustrates how disparate the views are. Consistent with national and international trends, in 1994 the expenditures of California utilities for R&D began a steep decline from about 0.8 percent of gross revenues to about 0.4 percent of gross revenues. The California Public Utilities Commission (CPUC) working group that addressed R&D included proposals on funding for Public interest R&D that ranged from about 0.1 percent of gross utility revenues to about 0.8 percent of gross revenues. The California restructuring legislation ultimately settled on about 0.3 percent of gross revenues ($62.5 million per year). California's restructuring legislation also made provisions for other public purpose programs, including energy efficiency, renewable energy, and low-income programs. Total expenditures for public purpose programs will be about 2.5 percent of gross revenues.

Concerning the funding mechanism, the basic alternatives are taxation and ratemaking. Taxation requires legislation, while ratemaking usually lies within the jurisdiction of regulators. Tax laws can provide incentives for R&D through tax credits or direct support for R&D through new or existing taxes. Taxes may be at the national level or at the state level. Ratemaking would create rate components that could be voluntary or mandatory. Rate components may be collected at the transmission system (federal jurisdiction) or at the distribution system (state jurisdiction). The establishment of independent system operators (ISOs) to operate transmission systems in multi-state areas makes regional funding mechanisms possible since a public purpose component can be included in an ISO's rate structure.

### Governance

The issues here concern who decides how the public interest R&D funds are spent. This involves both a choice of organizational form and a choice of people (as governing boards and administrators). Organizational forms include not-for-profit corporations, government agencies and quasi-governmental agencies (e.g., a government chartered corporation). These organizations can be dedicated to public interest energy R&D or they can be multi-purpose (e.g., also conducting public interest R&D on nonenergy topics, or nonpublic interest R&D, or other functions such as energy efficiency programs). There are many possibilities for membership of governing boards (e.g., utility industry representatives, representatives of all stakeholders, public officials, disinterested experts) and for administrators (e.g., administrators serving at the pleasure of a governing board, political appointees, civil servants).

**Scope**
The issues here concern geographic scope (state, regional or national), energy types addressed (electricity, natural gas or both), technology focus (for example, end-use efficiency, renewables, environmental issues, advanced generation, system reliability, or combinations of these and other topics), and types of public interest R&D activities undertaken (basic research, applied research, product development, demonstration, commercialization or combinations of these).

## Results From the Breakout Sessions

The three breakout sessions were held concurrently and each addressed the following questions:

- What is "public interest" energy R&D? What are some of the issues that could interfere with the *development of a consensus definition* of what comprises public interest energy R&D?

- What will be the best *forms of governance* for overseeing the conduct of public interest energy R&D?

- What will be the best *mechanisms for funding* public interest energy R&D?

In the sessions several general points were raised about the policy development process for public interest energy R&D. There seemed to be general agreement that no matter how public interest energy R&D is defined, private spending appears to be declining. The effects of this decline, in terms of foregone public benefits, are not known, but the general belief is that they could be substantial. To better understand the possible foregone benefits, an important step in the policy development process is to define the Public interest energy R&D needs and gaps and then determine the funding requirements and priorities. This step could occur at the state, regional, or national levels.

The role of government in accomplishing public interest energy R&D is critical, but there was general agreement that it may be premature to precisely define it. A collaborative mechanism is probably needed among the states, federal agencies, electric and gas utilities, interest groups, and others to develop policy options and recommendations. This need not involve new institutions, but could involve better collaboration among existing entities.

The following points summarize major common themes and conclusions from the three breakout sessions.

- The definition of public interest energy R&D should focus on capturing projects with broad public benefits that are also unlikely to be conducted without government intervention. A consensus definition will be increasingly important as policymakers debate issues related to governance and funding of public purpose energy R&D. The value of public purpose research is largely derived from its contributions to overall policy goals. Thus, definitions may differ, depending on the perspectives of policymakers at both the

state and national levels. In terms of the general public, there is a great need not only to define but also to tangibly demonstrate the benefits of public interest energy R&D.

- Existing federal and state programs governing public interest energy R&D should continue. Any new organizations, should they be deemed necessary, should take maximum advantage of the current institutional infrastructure.

- A guiding principle for determining the structure of governance is that those who fund public interest energy R&D should play the greatest role in deciding how it is carried out. If, for instance, taxpayer funding is increased, there should be more input from the general public and groups that represent their interests. As much as possible, it is important that the governance structure avoid politicization and introduce mechanisms to ensure stable, long-term funding for ongoing projects.

- Many of the proposed funding mechanisms hold promise for generating additional funding support for public interest energy R&D. While methods such as taxes, wires charges, tax credits and incentives each have some drawbacks, they represent potential ways to supplement continued congressional appropriations. More work needs to be done, however, to explore new and innovative ways to generate support for public interest energy R&D. Novel approaches¾such as a system to allow customers to check-off contributions on their tax or utility bills¾could be explored. Regardless of the specific funding mechanism, stronger connections should be made between the funding and the benefits of public interest energy R&D. This means that the level of public awareness and involvement (or that of the public's elected representatives) in setting energy R&D directions and priorities should be substantially higher in the future than it is today.

- The participants felt strongly that the discussions that took place at the meeting should not be the final word in the policy development process. As restructuring unfolds across the country, there will be a continuing need for the organizations represented at this meeting to share information about public interest energy R&D needs and gaps and the possible solutions for sustaining funding levels.

- The fact that complete consensus was not achieved regarding the best forms of governance or mechanisms for funding Public interest energy R&D was neither surprising nor discouraging for the participants. They were adamant in not wanting the lack of consensus to be misinterpreted as a barrier to the eventual development of effective policy solutions. As a first time event by the sponsoring organizations, the meeting was viewed as the initial step in a multi-step process, particularly since electricity and natural gas R&D issues have never before been considered jointly in a forum of this type.

## NARUC R&D

Among the utility regulatory participants at the dialog, there was sufficient consensus on the subject that NARUC participants (state commissioners) brought a resolution of support to protect public purpose R&D to their national association. At its November 10-12, 1997, meeting in Boston, NARUC unanimously adopted a *Resolution on Public Purpose Research and Development in the Electricity and Natural Gas Industries.* It is now NARUC policy that its committees are charged with continuing to seek solutions to the challenges of maintaining

the benefits of public purpose energy research and development, based on the following principles:

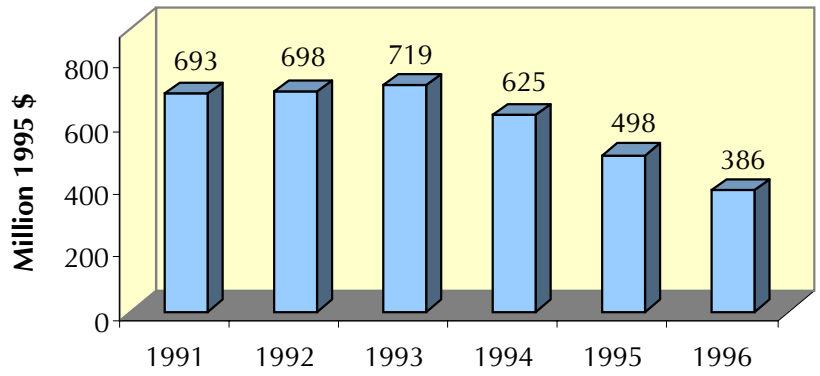
- The public receives important net benefits from public purpose research and development;
- Public purpose research and development should be better defined and communicated so the public will understand its benefits and costs and its relationship to public policy goals;
- Public purpose research and development should continue to be performed by institutions such as EPRI, GRI, the national labs, and other state-level and national-level entities;
- State and federal governments should intervene in markets to the extent needed to continue public purpose research and development;
- Public purpose research and development should be administered by institutions with governance responsive and accountable to their funders;

In addition to voluntary support, funding for public purpose research and development should be provided, to the extent needed, by some combination of mechanisms, perhaps including, but not limited to taxes, tax credits, or non-bypassable system charges.

# Introduction

The restructuring of the electricity industry has been accompanied by a sharp decline in research and development (R&D) expenditures by investor-owned utilities (IOUs). This trend is clearly illustrated by figure 1. The figure is based on Federal Energy Regulatory Commission (FERC) filings by 110 companies that are responsible for more than 90 percent of IOU expenditures for research, development and demonstration (RD&D). It shows that, in the 1990s, expenditures peaked in 1993 and then fell by more than 45 percent between 1993 and 1996. The trend in the United States of declining utility expenditures for energy R&D is consistent with expenditure trends in other countries where the electricity industry has been or is being restructured.[1]

**Figure 1. Investor-Owned Utility Research, Development and Demonstration (RD&D) Spending, 1991-1996**




Note: Represents internal and external electric power RD&D spending.

**Source:** Calculated from TECC Consulting Group 1996a, TECC 1996b, TECC 1997.

A key driver of this trend is competitive pressures to cut costs. "While cuts are occurring across the board, RD&D departments are particularly vulnerable because in most cases research projects are not considered essential to the operation. In addition, the value of RD&D projects are difficult to quantify and often seen as a long-term investment. These trends are particularly prevalent for IOUs positioning themselves to increase profits for shareholders." [2] Although, in retrospect, this trend does not seem surprising, it certainly was not an intended consequence of restructuring. Intentions notwithstanding, policymakers now are confronted with the questions of (1) how will this decline affect the public interest and (2) if some of the effects are adverse to the public interest, what mitigating steps, if any, should be taken?

1. Dooley, 1997.

2. Schilling and Scheer, 1997, p. 11.

Technological change is an important contributor to economic growth and R&D is an important contributor to technological change. Any sharp decline in R&D expenditures is, at the least, a cause for concern. On the other hand, restructuring is moving the business of electricity generation decisively toward competition. If history is a guide, this competition will be conducive to innovation. New R&D investments may be forthcoming from the competitors or their suppliers. Thus, concern with the current decline in R&D expenditures should focus on the R&D, if any, that will not be adequately provided by the competitive market. Especially at risk are R&D projects that, from a societal perspective, have measurable public benefits but that private markets probably will be unable to support without some form of government intervention.

Because of its concern that beneficial public interest R&D may be at risk in restructured, more competitive energy Industries, the National Association of Regulatory Utility Commissioners (NARUC) resolved to convene an *Executive Dialog on Public Purpose Research and Development in the Electric and Gas Utility Industries.* This dialog was held on October 14-15, 1997, in St. Louis, Missouri. The purpose of the meeting was to assemble a group of executive-level decision makers from the electricity and natural gas Industries to explore the relative merits of alternative policy options for continuing public interest R&D in restructured utility markets.

The two-day meeting involved a series of presentations by various experts and three breakout sessions. A copy of the meeting agenda can be found in appendix A. There were 115 participants at the meeting who represented a variety of organizations and points-of-view, including electric and natural gas utilities, state energy R&D agencies, public utility commissions, the Electric Power Research Institute (EPRI), and the Gas Research Institute (GRI).

Presentations addressed a variety of issues and trends in R&D directions and priorities for the electric and natural gas utility Industries and included an overview of alternative policy mechanisms based on a discussion paper prepared for the meeting entitled *Strategic Options for Public interest Energy R&D*. This paper provided a definition and five examples of public interest R&D. It then defined the issues and presented a range of scenarios in terms of (1) funding options, (2) governance options and (3) options in scope of the R&D. The strategic options paper is included in section 2 of this report.

Three breakout sessions were held concurrently on the second day of the meeting. During these sessions, participants discussed issues raised in the strategic options paper. These issues included questions related to the definition of public interest energy R&D, the best forms of governance of public interest R&D, and alternative mechanisms for funding Public interest R&D. A list of the participants in the breakout sessions can be found in appendix B. Section 3 of this report summarizes the results of each of the three breakout sessions.

Subsequent to the executive dialog, at its Annual Convention in Boston November 10-12, 1997, NARUC unanimously adopted two resolutions intended to protect public purpose R&D. One derived wholly from discussions at the Executive Dialog. The other is a broader resolution with elements that derive directly from the dialog. These two resolutions are presented in section 4 of this report.

As competition in the energy utility industries increases around the nation, cost pressures increase and new, unregulated entities enter the business. As a result utilities are shifting their attention is shifting to competitive issues. This translates into increased emphasis on being the low-cost provider and greater demand for immediate, low-risk R&D investment return. Although many utilities continue to participate in a broad range of R&D activities, some utilities have begun to focus their R&D investments on shorter-term competitive issues. The overall result is a trend toward reduced R&D investment and the elimination of some longer-range programs that would have provided less immediate competitive advantage. This trend is especially marked in California, where utility R&D investments fell by more than 50 percent after the California Public Utilities Commission (CPUC) issued its initial order proposing to increase competition in the electric industry by restructuring.

Some observers anticipate that this trend will continue in the more competitive environment that results from restructuring and that overall investment in R&D will decline. Others believe that, after restructuring is complete, competition will stimulate renewed R&D investment. Regardless of which view is held, most agree that there will be few clear incentives for a firm to invest extensively in R&D that has benefits that are non-proprietary and largely external to the firm. This is a concern because there may be a body of important R&D that will not be adequately provided for by the competitive market, since some or all its benefits are widely distributed and cannot be captured by individual companies. This R&D has become known as "public interest R&D." Public support may be warranted for public interest R&D that receives reduced support from the energy industry as restructuring unfolds. Public support is likely to be most effective if it continues to complement, rather than substitute for, private support for science and technology development.

Because of the changes in the energy industry, it is appropriate to reexamine energy R&D and the historical public/private partnership for R&D. This paper is intended to contribute to this reexamination by stimulating discussion about public interest R&D. First the definition of public interest is addressed so that readers can form an opinion about what is at stake. Then, some of the strategic options are examined for dealing with public interest R&D during and after restructuring.

# The Discussion Paper: Strategic Options

## What Is Public Interest Research and Development?

The short definition of public interest R&D considered here is: *R&D that is not adequately provided by the competitive market, since some or all of its benefits are widely distributed and cannot be captured by individual companies*. Among the areas where the benefits of public interest R&D may be important are health, safety, environment, energy efficiency and precommercial technical information. Many R&D projects have both private and public benefits. Some examples will help to clarify what kinds of R&D might be classified as public interest R&D. These examples are arranged roughly in order of increasing private benefit relative to public benefit. The R&D described in each of the examples has received substantial utility funding, with the costs usually passed to ratepayers. Significant federal funding also has supported the R&D in all the examples, and private funding has supported the development of commercial products. Note that sometimes the classification of a project as public interest R&D is subjective, depending upon how one judges the balance between public benefits and incentives for private investment. It is left to the reader to decide whether all the examples given here can properly be classified as public interest R&D.

### *Example 1: Combustion Science*

Fundamental studies of combustion are being undertaken to learn more about the processes by which nitrogen oxides (NOx) are formed in practical burners. One purpose of these fundamental studies is to develop information to guide the design of future high-performance burners. The design objective is ultra-low-NOx emission without sacrificing combustion efficiency, combustion stability or turn-down capability. Because NOx formation in practical burners is complex, manufacturers have relied to date on empirical, "cut-and-try" methods to obtain improved performance. Although this approach has had some success, further gains will require an understanding of the processes by which NOx is formed and overall performance is maintained. Sufficient progress has been made in the fundamental studies for some new burner designs to be based on scientific theory developed by combustion researchers, and there is hope that this approach will lead to a new generation of ultra-low-NOx burners. For the most part, results from fundamental studies of combustion cannot be appropriated by the sponsor of the research. Usually, they are published in the open literature.

In this example the result of the research is a pure public good. This means we mean a good that is free and has the property that one person's use of the good does not impair its use by another person. Note that the term public good here is used here in a technical sense, as an economist would define it. The term "public benefit" is used to refer in a more general sense to things that are good for the public. Information that is in the public domain is an example of a public good.

### *Example 2: Residential Heating and Cooling Ducts*

Research in the early 1990s showed that residential ducts—the tubes in the attic, crawl space or basement that circulate air between the heater or air conditioner and the living space—were a major source of energy waste. Typically, about one-third of the energy that flows through residential ducts is lost through leaks. This loss is estimated to cost U.S. homeowners

several billion dollars annually. Because the research established that residential ducts leak and that information was made widely available, efforts are under way around the country to find methods to fix the problem in existing housing and to prevent it in new construction. The research created commercial opportunities: new technologies for sealing ducts are beginning to reach the market. However, it seems highly unlikely that any private party would have undertaken to create these opportunities by measuring the performance of ducts and making the results available to the public.

The research in this example also produces a pure public good. However, this research is much more near-term and applied than combustion science. Long-term and fundamental are not necessary characteristics of public interest R&D.

### *Example 3: Venting Technology*

Conventional gas furnaces provided trouble-free venting when used in residences because relatively high temperatures made the flue gas buoyant. To increase efficiency and comply with new federal standards, fan-assisted gas furnaces were developed that have lower flue gas temperatures, reduced air flow, and combustion fans instead of draft hoods. These changes increased the risk of condensation in venting systems that were designed for conventional atmospheric furnaces. Condensation can cause corrosion and premature failure of the venting system. Research efforts led to the development of new venting guidelines to meet residential space heating needs.

The venting guidelines produced by the research in this example are a public good. The creation of guidelines and standards also can provide immediate private benefits. By giving consumers assurance regarding safety and reliability, guidelines and standards help to create markets for new products. Compliance with guidelines and standards can reduce the liability exposure of manufacturers and contractors.

### *Example 4: Solid State Invertors*

The ability to convert direct current into alternating current is a key enabling technology. Enabling technology is technology that makes it possible to accomplish a number of different technical ends. For example, PhotoVoltaic cells and fuel cells both produce direct current that must be converted to alternating current for most Uses. Many variable speed drives for electric motors also require conversion of direct current to alternating current. Solid-state invertors are one device that is used to accomplish this conversion. R&D during the past 15 years has substantially reduced the cost and improved the efficiency of these devices. Efforts to improve these devices are continuing. This R&D has had direct private benefits for firms that are engaged in the production of solid-state invertors. However, these firms can capture only a small fraction of the benefits from the technologies that are enabled by these devices. Most of the benefit spills over to other firms and to the public at large.

In this example the benefit of the R&D to the public comes from the fact that better, cheaper private goods are becoming available. Of course, this might be said of most R&D that was aimed at developing new products. In these cases one must decide if the R&D is public interest R&D or if it is R&D that will be adequately provided by the competitive market. In practice this question has often proved difficult. A judgment call must be made: is the public benefit large enough and are the private incentives too small? The case for classification as

public interest R&D is easier to make when an enabling technology is involved because of the significant potential for spillover benefits.

### *Example 5: Biopulping*

Paper is made by a process that converts wood into a pulp. Pulping is an energy and chemically intensive process. During the past decade, private research (with some federal assistance) yielded the promising prospect that common fungi could be used to partially decompose wood in advance of the pulping process, saving significant costs in terms of energy, chemicals and environmental effects. In spite of this promise, the consortium working on this technology was unwilling to fund the next stage of development, a mill trial of the technology. At this point, because of the potential public benefits, ratepayer funds were made available to the consortium and a mill trial was initiated. Mill trial results to date have been promising. The commercial success of the technology is not yet certain, but private interest has been rekindled and prospects are encouraging. If commercial success is achieved, paper production costs and environmental costs will be decreased. Commercial success also will generate licensing revenues that will be shared, with some going to future public interest R&D.

In this example a primary public benefit is the significant spillover benefit that results from reduced environmental effects. In addition, for regions where paper making is important, biopulping may contribute to the economic health of the region. This example also illustrates how arrangements—such as royalty sharing—can be made for the public to participate in the private benefits produced by an R&D project.

## The Issues

The discussion of strategic options for public interest energy research will be framed in terms of three broad topics: funding, governance and scope.

### *Funding*

Assuming that some body of R&D can be identified as unsupported by the market and that the benefits of pursuing this R&D should not be foregone, issues arise about how to pay for this R&D. These issues concern how much funding should be provided and by what mechanisms this funding should be collected.

Concerning how much, there is no consensus. The debate in California illustrates how disparate the views are. Consistent with national trends[3] and trends in other countries where the electricity industry has been or is being restructured, [4] in 1994 the expenditures of California utilities for R&D began a steep decline from about 0.8 percent of gross revenues to about 0.4 percent of gross revenues. The CPUC working group that addressed R&D included proposals on funding for Public interest R&D that ranged from about 0.1 percent of gross utility revenues to about 0.8 percent of gross revenues[5]. (RD&D working group 1996). The California

3. Schilling and Scheer, 1997.

4. Dooley, 1997.

5. RD&D working group, 1996.

restructuring legislation ultimately settled on about 0.3 percent of gross revenues ($62.5 million per year). California's restructuring legislation also made provisions for other public purpose programs, including energy efficiency, renewable energy and low-income programs. Total expenditures for public purpose programs will be about 2.5 percent of gross revenues.

Concerning the funding mechanism, the basic alternatives are taxation and ratemaking. Taxation requires legislation, while ratemaking Usually lies within the jurisdiction of regulators. Tax laws can provide incentives for R&D through tax credits or direct support for R&D through new or existing taxes. Taxes may be at the national level or at the state level. Ratemaking would create rate components that could be voluntary or mandatory. Rate components may be collected at the transmission system (federal jurisdiction) or at the distribution system (state jurisdiction). The establishment of independent system operators (ISOs) to operate transmission systems in multi-state areas makes regional funding mechanisms possible, since a public purpose component can be included in an ISO's rate structure.

### *Governance*

The issues here concern who decides how the public interest R&D funds are spent. This involves both a choice of organizational form and a choice of people (as governing boards and administrators). Organizational forms include not-for-profit corporations, government agencies and quasi-governmental agencies (e.g., a government chartered corporation). These organizations can be dedicated to public interest energy R&D or they can be multi-purpose (e.g., also conducting public interest R&D on nonenergy topics, or nonpublic interest R&D, or other functions such as energy-efficiency programs). There are many possibilities for membership of governing boards (e.g., utility industry representatives, representatives of all stakeholders, public officials, disinterested experts) and for administrators (e.g., administrators serving at the pleasure of a governing board, political appointees, civil servants).

### *Scope*

The issues here concern geographic scope (state, regional or national), energy types addressed (electricity, natural gas or both), technology focus (for example, end-Use efficiency, renewables, environmental issues, advanced generation, system reliability, or combinations of these and other topics), and types of public interest R&D activities undertaken (basic research, applied research, product development, demonstration, commercialization or combinations of these).

## Strategic Options

The strategic options are discussed here in order of increasing government control over public interest R&D. The options are explained using a series of hypothetical examples of post-restructuring R&D support mechanisms. The examples include a description of funding, governance and scope, followed by an analysis of some of the pros and cons of the choices made concerning these issues. Although the examples help define the important features of different structures for using public interest R&D funds, they should not be viewed as providing definitive choices. Currently, a mix of organizations administer and perform public interest energy R&D for a variety of audiences and purposes. As the energy industry changes, it is reasonable to expect that the organizations and the mix of organizations also will change. The challenge, then, is to understand and pursue the future mix of R&D administrators and

performers that will provide the best value to the public after restructuring. It must be emphasized that the four options that are discussed below—under the headings direct industry control, industry directed not-for-profit, publicly directed not-for-profit, and direct government control—are not mutually exclusive and do not begin to exhaust the possibilities.

### *Direct Industry Control*

This option relies upon private industry to perform R&D that delivers public benefits. Firms in the industry determine both the levels of investment in R&D and the areas for investment. Funding is provided both by shareholders and, in the regulated parts of the industry, through rates approved by regulators. As a further spur to R&D, incentives are created to increase investment for targeted technology areas. These incentives include increased tax credits for selected research areas that address public benefits and more liberal tax deductions for R&D expenses under state or federal tax laws. Industry efforts are guided in part by R&D "roadmaps." These roadmaps have two basic components: an industry-wide agenda identifying the essential R&D necessary to meet global competitive conditions and the assignment of responsibility for the work that needs to be done. The development of the roadmaps is guided by the participation and assistance of public officials. This provides an avenue by which public benefits can be included on private agendas. Partly as a result of this public sector participation, the roadmaps include environmental issues as high priorities for further research and development.

### *Pros and Cons*

The public benefits of this option may be largely those benefits that will flow to the public if, through increased R&D, the energy industry becomes more efficient and competitive. In the past, strategies for increasing efficiency and competitiveness of an industry by encouraging R&D have been associated with industrial policy ventures. In examining the pros and cons of the direct industry control option, one needs to consider the relationship between industrial policy ventures and public interest R&D programs. Are the latter a subset of the former or are they distinct, complementary (or perhaps competing) strategies?

***Funding.*** This option depends on funding from private firms. Evidence of the potential for private funding for R&D is that numerous incumbent utilities as well as new entrants to the electricity market have indicated that their business plans rely on technology-based product or service differentiation strategies. This suggests that a growth in energy-related R&D may be imminent. Funds for public interest R&D could be delivered if a market demand for the benefits arises. As an example, some consumers have expressed a preference for environmentally benign supply technologies or "green power." To meet this demand, firms have begun investing in renewable resource technologies and may begin to invest in R&D. However, the incentive to conduct public interest R&D will be weak, since an individual company cannot capture a proprietary interest in the benefits of public interest R&D. Although a company may seek value in corporate image by being a pioneer, it is not likely to gain a direct competitive advantage for very long by conducting public interest R&D. On the contrary, its competitors may realize equal benefits from the R&D without having to bear the costs—in effect, a competitive disadvantage for the company that bears the costs of the R&D.

Tax credits and the liberalization of deductions may increase the funding for public interest R&D by shifting some of the expense from industry to the general public. This is most likely

to be effective in cases where the R&D has a mix of public and private benefits. That is, when a private firm wants to commit its resources primarily to capture the private benefits; then government support helps to underwrite the public benefits portion. Tax credits, especially credits for targeted technology areas, may be difficult to administer because it may be difficult to separate R&D expenditures that qualify for the credit from those that do not.

Funding for public interest R&D might also be provided if regulatory agencies establish technology-forcing regulations because R&D may be needed in order for market participants to comply with these regulations. As examples, some state regulators are considering "portfolio standards," rules requiring that some portion of power retailers' supplies be produced from renewable resources. Other states are considering disclosure requirements that provide consumers who are selecting a power producer with information about the source of its electricity and the environmental effects at the point of production. Along these same lines, environmental regulations create a demand for compliance technologies, spurring demand for research and development in control or mitigation technologies.

***Governance.*** For-profit firms are a flexible and efficient organizational form. As demonstrated by the semi-conductor industry and other high-tech Industries, for-profits companies can be highly effective in managing R&D. However, in the utility industry—which makes relatively much less investment in R&D than do high-tech Industries—some new infrastructure for managing R&D may need to be created. In addition, the roadmapping strategy requires some mechanism for competing firms to cooperate. This mechanism might be provided by existing institutions. For example, the Department of Energy and the Electric Power Research Institute both are engaged in roadmapping efforts for the electricity industry. However, sustaining this cooperation may require funding and, possibly, anti-trust exemption.

***Scope.*** Because of restructuring, the geographic scope of the direct industry control option will depend on the industry sector involved. In the distribution sector the scope will be local (i.e., intra-state service territories), in the transmission sector the scope will be increasingly regional, and in the supply sector the scope will be increasingly both regional and national. It is a concern, especially in the distribution sector, that many of the firms will be too small to have effective R&D programs.

Because the firms conducting R&D in the direct industry control option will be participants in the energy market, R&D efforts will be closely connected to the market. A drawback to this arrangement is that a firm's R&D program may be unduly influenced by other objectives of the firm. This can cause the program to overemphasize private benefits and short-term objectives and to move from R&D toward technical support (e.g., product testing). Firms that emphasize private benefits may gain a competitive advantage over firms that pursue public benefits. An additional concern is that, because R&D is likely to be such a small part of the business,[6] R&D may not receive adequate attention from top management. It could be argued that the small share of utility budgets for R&D makes utilities very different from high-tech Industries like semiconductors and, therefore, that R&D strategies that work in high tech Industries will not work for utilities.

6 . U.S. General Accounting Office, 1996. Electric utility expenditures on R&D in 1995, including contributions to collaborative efforts like EPRI, were less than 0.5 percent of gross revenues.

### *Industry Directed Not-for-Profit*

An industry directed not-for-profit would be governed by a board of directors appointed and controlled by industry representatives. The energy industry has historically relied upon industry -directed not-for-profit institutions to plan, fund, and manage research and development related to public benefits. The Electric Power Research Institute (EPRI) and the Gas Research Institute (GRI) perform collaborative research for large segments of their respective Industries, much of which delivers public benefits. The example for this option discusses a hypothetical new not-for-profit corporation.

In response to the concerns of regulators about the effect of restructuring on Public interest R&D, firms in the electricity industry establish the Electricity Public interest Research Corporation (EPIRC). Part of the motivation for establishing EPIRC is the belief of its founders that a less desirable alternative will be mandated if industry does not take the lead. Membership in EPIRC is voluntary and is open to distribution companies, ISOs, generating companies, and companies that integrate two or more of these functions. EPIRC funding comes from member dues. For distribution companies, dues are collected through rates approved by state regulators. For ISOs, dues are collected through a fee approved by FERC. For generating companies, the cost of dues is borne by shareholders. Nuclear Regulatory Commission (NRC) regulations have the effect of encouraging owners of nuclear generation to remain members. The board of directors of EPIRC is elected by the members. Eighty percent of the directors must be officers of the member firms. The other 20 percent of the members are selected by the board to represent the public interest. An advisory council helps to guide EPIRC's program. The council consists of members of NARUC and representatives from universities, environmental organizations, state energy agencies, and private business. The board appoints EPIRC's chief executive officer who serves at the pleasure of the board. EPIRC's sole business is public interest R&D and its entire R&D agenda is related to electricity.

### *Pros and Cons*

***Funding.*** This strategic option relies upon the electricity industry, including its new constituents, to continue to participate in collaborative research aimed at producing public benefits. Since membership is not mandatory, EPIRC cannot become complacent—if members do not see value, they will withdraw. To the extent that distribution companies and ISOs do not have competition and can pass the costs to consumers, their decisions to participate in EPIRC will be similar to decisions being made today about participation in EPRI. However, competing generating companies probably will not be able to pass along their costs of participation and their decisions will have a different character. They will be looking for value that exceeds the cost of membership. This will put EPIRC under pressure to do two things that may detract from public interest R&D: 1) look for ways to provide benefits that can be appropriated by the members and 2) look for ways to exclude nonmembers from benefiting from the EPIRC research.

***Governance.*** As a new organization, EPIRC had the usual start-up problems and, in addition, had to establish appropriate relations with existing R&D organizations—especially EPRI. EPIRC's board is much more heterogeneous than a board that might have been established before restructuring. This is because there are many fewer integrated utilities on the board. It is not clear how closely the interests of distribution companies, ISOs, and generation compa-

nies will be aligned after restructuring is complete. For example, distribution companies may want to deliver energy efficiency services, while generation companies may see energy efficiency as a threat to profits. These kinds of differences could make it difficult for a board of industry stakeholders to give coherent guidance to the organization. On the other hand, decision making benefits from a stakeholder board's diverse technical perspectives and intimate knowledge of the industry 's concerns.

***Scope.*** As a national organization, EPIRC has the appropriate geographic scope for many of the industry 's technical problems. Examples of national problems include gas turbine technology, applications of superconductors, and the technology for distribution automation. However, there also are many technical problems that are regional in scope. Examples of regional problems are sulfur oxide pollution, air conditioning technology for dry climates, and air conditioning technology for humid climates.

EPIRC's dedication to electricity R&D is consistent with its funding by the electricity industry. This is a drawback for public interest R&D because research topics that affect both electricity and natural receive may get low priority (for example, the insulating properties of building windows and walls). There also may be a tendency to give undue emphasis to the development of technologies that increase electricity use by displacing natural gas (for example, heat pumps).

### *Publicly Directed Not-For-Profit*

A publicly directed not-for-profit would be governed by a board of directors appointed by a public agency or otherwise constituted to represent the public. The members of the board might be experts that are not affiliated with any stakeholder group or they might be chosen to represent a cross section of stakeholders such as public interest groups, industry, research organizations, trade allies, regulators, and utilities. In our example for this option we discuss a hypothetical new regional organization.

Restructuring results in the creation of an ISO in a three-state region. A new organization is formed to sustain public purpose programs. It is a not-for-profit corporation named the Regional Organization for public purpose Programs ("Regional"). Regional is to be funded by an increase in the ISO's fee to be ordered by FERC at the request of the regulatory commissions in each of the three states. The uplift is a non-bypassable charge. Regional has a nine-member board; each state regulatory commission appoints three of these board members. Board members must act, to the best of their ability, in the interest of the corporation (that is, they do not represent stakeholders). The board appoints Regional's chief executive officer, who serves at the pleasure of the board. Regional spends only 15 percent of its income on R&D, 30 percent is spent on renewable resources and the balance is spent on energy-efficiency programs. Regional's charter requires that it conduct public interest energy R&D without any other limitations on the scope of that R&D. The current plan is to address both electricity and gas with a focus on applied research, product development, and demonstration related to Regional's renewables and energy efficiency missions.

### *Pros and Cons*

***Funding***. Regional's proposed funding arrangement requires considerable inter-state and state-federal coordination—it may be difficult to achieve. Since the fee is non-bypassable, there will be no in-region "free riders." However, the mandatory character of Regional's funding may undercut existing voluntary organizations and cause Regional to be less responsive to stakeholders. An alternative might be to let utility distribution companies (UDCs) direct a portion of the fee to other voluntary R&D organizations. Such competition among providers of public interest R&D might be salutary, but this competition probably should be structured so that it is not based primarily on which provider can best serve the private interests of UDCs. Also, it will be undesirable if coordination among R&D organizations is unduly discouraged.

***Governance***. As a new organization, Regional had the disadvantage having to spend considerable time and effort on start up—hiring staff, setting up management systems, etc. However, it had the advantage of not having pre-existing commitments to people and programs that might distract from its mission. As a not-for-profit corporation, Regional operates under a time-tested and highly flexible organizational form. The main objection to this form of organization is that it is not as accountable as a government agency. Because Regional's board is not a stakeholder board, it may lack the intimate knowledge of the industry 's concerns that stakeholders would provide. On the other hand, board members are less likely to pursue strategies aimed at advancing parochial interests. An example of such a strategy might be a board member who obtains support for research that furthers his interests by agreeing to support research that furthers the interests of another board member. An advisory board of stakeholders is an alternative way to provide Regional with some stakeholder input, but the link is much weaker than that obtained through a governing board.

***Scope***. Some advantages of a regional organization are that it has a large enough base to establish a significant program, but it is small enough to address relatively local concerns. Among the disadvantages are that many of the R&D problems are national in scope (regional spending on national problems creates a free-rider problem) and regional governance is politically difficult (institutions are better able to deal with issues at the state or national level). Because most of Regional's funds will be spent on programs other than R&D that promote renewables and energy efficiency, Regional's R&D program in these areas will be closely connected to the market. As with other examples where R&D is not the main activity of the organization directing the R&D, a drawback is that the R&D program may be unduly influenced by the other larger programs. Again, this can cause the program to overemphasize short-term objectives and to move from R&D toward technical support. Also, Regional's focus on energy efficiency and renewables also may mean that other important areas for Public interest R&D (for example, system reliability) receive less attention. The strong market-connectedness of Regional's R&D program should create many opportunities for leveraging Regional's funds through public /private partnerships to develop new products. A potential danger of this kind of leveraging is that the private interests in these partnerships will outweigh the public interest and Regional will, in effect, be taking a role that normally is left to venture capitalists.

A justification for Regional's decision to address both electricity and natural gas is the significant overlap (for example, gas turbines and many areas of end-use efficiency) and that public interest R&D programs should be neutral on issues related to inter-fuel competition. On the other hand, since Regional's funds come from electricity sales, the decision to address both fuels raises equity concerns (natural gas companies and consumers will be free riding.)

### *Direct Government Control*

Direct government control is governance in which the allocation of funds to R&D projects is directly controlled by a government agency. Possible forms of organization include an executive agency such as the U.S. Department of Energy (DOE) or a regulatory agency such as the California Energy Commission (CEC). The hypothetical example we used here is patterned after the Public interest Energy Research (PIER) program being established in California. PIER is still under development, so part of what is described here is speculative.

In 1996 the California Legislature passed restructuring legislation that created a rate component for public purpose programs. The legislation set aside $250 million ($62.5 million per year) for the period from 1998 through 2001 for Public interest R&D. The level of funding, if any, after 2001 will be determined by the CPUC. For the initial four years, most of the funds ($61.8 million per year) have been transferred to the CEC, which established the PIER program. The CEC has five commissioners who are appointed by the governor. By statute, the commissioners are a lawyer, an economist, an engineer, an environmentalist and a representative of the public at large. PIER is managed by a staff that reports to a two-commissioner committee. All R&D contracts are approved by the full commission. The CEC had previous experience with R&D, since it has managed a relatively small (less than $3 million per year) program to support the development of new energy technologies for about 10 years. The CEC has other missions, including development of energy policy, power plant siting, energy demand forecasting, promulgation of building standards, and the operation of a program that supports renewable electricity generation. Because the CEC had some experienced personnel and because restructuring resulted in staffing reductions for some of its other missions, only a few new staff were hired for the PIER program. The PIER program is directed by legislation to focus on five core subject areas: environmental enhancements, end-use efficiency, environmentally preferred advanced generation, and strategic issues including electricity system reliability. PIER's R&D agenda is not exclusively electricity, but it emphasizes electricity.

### *Pros and Cons*

***Funding.*** Funding for public interest R&D was recommended in the CPUC's policy decision on restructuring. However, the CPUC believed that it did not have authority to order such funding and that, therefore, legislation was necessary. Implementing the California strategy on a national scale might require separate legislation in many states. Arguably, states that do not provide for public interest R&D could be free riders, benefiting from other states' programs without paying for them. Because utility support is mandatory, the CEC will have four years of funding stability to establish the PIER program. However, this stability could cause the CEC to become complacent.

***Governance***. As an established organization, the CEC did not have to devote time to start-up. However, some of its policies and procedures are not well suited to conducting an R&D program and a good deal of effort must be devoted to making changes. State procurement regulations are a particular problem—the procurement process is inflexible and time consuming. As a state agency subject to an annual budgeting process, the CEC is highly accountable to the governor and the Legislature. The drawback of this kind of accountability is that it may make the CEC subject to undue political pressure concerning the awarding of research funds. The CEC is set up to involve stakeholders in its regulatory decision making process. There are many opportunities—including hearings, workshops and informal contacts—for stakeholders to advocate their positions. However, this openness is not necessarily conducive to decisive action or administrative efficiency.

***Scope***. Because of California's size, the PIER program is effectively regional in scope. PIER has a large enough base to establish a significant program, but the geographic scope is small enough for it to address regional concerns. However, as noted in the discussion of other options, many of the energy Industries technical problems are national in scope.

## Conclusion

The obvious conclusion from the above discussion is that none of the options described is sufficient by itself to provide for public interest R&D after restructuring. In the past, Public interest R&D was sustained by a mixture of public and private, regulated and unregulated, and federal and state institutions and support mechanisms. Today, in the midst of restructuring, it is not surprising that some of these arrangements are being disrupted, given the profound institutional upheavals now occurring in the energy industry. Public interest R&D is likely to suffer some serious damage if actions are not taken to deal with these disruptions.

The purpose of this paper is to stimulate discussion concerning what actions to take. The situation is complex, but the problems are by no means insoluble. Indeed, we think there are likely to be many workable solutions. Discussion of the issue will help begin to identify some of the better solutions and will contribute to the evolution of a new mixture of public and private, regulated and unregulated, and state and federal institutions and support mechanisms that will enable public interest R&D to continue providing benefits after restructuring.

# Summary of the Breakout Sessions

Three breakout sessions were held concurrently and each addressed the following questions:

- What is "public interest" energy R&D? What are some of the issues that could interfere with the *development of a consensus definition* of what comprises public interest energy R&D?

- What will be the best *forms of governance* for overseeing the conduct of public interest energy R&D?

- What will be the best *mechanisms for funding* public interest energy R&D?

A list of the participants in the three breakout sessions can be found in appendix B. The remainder of this report summarizes the results of the three breakout sessions.

## Major Findings and Conclusions

Several general points were raised about the policy development process for public interest energy R&D. There seemed to be general agreement that no matter how public interest energy R&D is defined, private spending appears to be declining. The effects of this decline, in terms of foregone public benefits, are not known, but the general belief is that they could be substantial. To gain a better understanding of the possible foregone benefits, an important step in the policy development process is to define the public interest energy R&D needs and gaps and then determine the funding requirements and priorities. This step could occur at the state, regional, and national levels.

The role of government in accomplishing public interest energy R&D is critical, but there was general agreement that it may be premature to precisely define it. A collaborative mechanism is probably needed among the states, federal agencies, electric and gas utilities, interest groups, and others to develop policy options and recommendations. This need not involve new institutions, but could involve better collaboration among existing entities.

### *Major Findings of the Breakout Sessions*

The following points summarize the major common themes raised during the three breakout sessions.

- The definition of public interest energy R&D should focus on capturing projects with broad public benefits that also are unlikely to be funded without government intervention. A consensus definition will be increasingly important as policymakers debate issues related to governance and funding of public purpose energy R&D. The value of public purpose research is largely derived from its contributions to overall policy goals. Thus, definitions may differ, depending on the perspectives of policymakers at both the state and national levels. In terms of the general public, there is a great need not only to define but also to tangibly demonstrate the benefits of Public interest energy R&D.

- Existing federal and state programs that govern public interest energy R&D should continue. Any new organizations, should they be deemed necessary, should take maximum advantage of the current institutional infrastructure.

- A guiding principle for determining the structure of governance is that those who fund public interest energy R&D should play the greatest role in deciding how it is carried out. If, for instance, taxpayer funding is increased, there should be more input from the general public and groups that represent their interests. As much as possible, it is important that the governance structure avoid politicization and introduce mechanisms to ensure stable, long-term funding for ongoing projects.

- Many of the proposed funding mechanisms hold promise for generating additional funding support for public interest energy R&D. While methods such as taxes, wires charges, tax credits and incentives each have some drawbacks, they represent potential ways to supplement continued Congressional appropriations. Exploration of new and innovative ways to generate support for public interest energy R&D should continue. Novel approaches—such as a system to allow customers to "check-off" contributions on their tax or utility bills—could be explored. Regardless of the specific funding mechanism, however, stronger connections should be made between the funding and the benefits of public interest energy R&D. This means that the level of public awareness and involvement (or that of the public 's elected representatives) in setting energy R&D directions and priorities should be substantially higher in the future than it is today.

### *Conclusions*

- The participants felt strongly that the discussions that took place at the meeting should not be the final words in the policy development process. As restructuring unfolds across the country, there will be a continuing need for the organizations represented at this meeting to share information about public interest energy R&D needs and gaps and the possible solutions for sustaining funding levels.

- The fact that complete consensus was not achieved regarding the best forms of governance or mechanisms for funding public interest energy R&D was neither surprising nor discouraging for the participants. They were adamant in not wanting the lack of consensus to be misinterpreted as a barrier to the eventual development of effective policy solutions. As a first-time event by the sponsoring organizations, the meeting was viewed as the initial step in a multi-step process, particularly since electricity and natural gas R&D issues have never before been considered jointly in a forum of this type.

## Breakout Session A

### *Definition of Public Interest Energy R&D*

Public policymakers—including members of Congress, state legislators, and state regulators—need to understand the definition of public interest R&D so that the role of government in supporting this type of R&D can be determined. There are several alternative ways to define public interest energy R&D. One approach is to determine the types of energy R&D that would be conducted by competitive markets in the absence of government support; the important R&D projects that would not be conducted then could be labeled public interest

energy R&D. In essence, public interest energy R&D encompasses those projects that will not be pursued by private companies in the competitive marketplace, but that still are valuable to society.

Another approach is to categorize public interest energy R&D projects according to the policy goals the research is intended to serve. For example, three frequently mentioned public policy goals for energy R&D are 1) lowering energy costs to consumers, 2) improving the quality of the environment, and 3) enhancing the nation's energy security.

Rather than developing a single definition of public interest R&D, there may be value in having the definition(s) emerge as an outcome of the utility policy process as it unfolds at the state, local, regional and national levels. This approach recognizes that problems, needs and values differ across the country, and that the relative importance of affordable energy, a clean environment, and a secure energy system vary from state to state. Because of these regional differences, a single definition of public interest energy R&D might have difficulty gaining acceptance in all parts of the country.

However defined, an important consideration in the development of public policies is the difficulty of identifying constituencies to support multi-year R&D efforts, in part because benefits of Public interest energy tend to be diffuse, difficult to measure, and often take several years to realize. These complications also can make it difficult to explain the value of public interest energy R&D to the general public and gain their support for specific programs. Because public education and involvement is an important aspect of defining the role of the government in supporting public interest energy R&D in increasingly competitive utility markets, it would be Useful to know public perceptions and priorities for public interest energy R&D and to gauge their current level of support.

The following points summarize the group discussion of the definition of Public interest energy R&D.

- Many participants felt it is important for policymakers to have a definition of public interest energy R&D, but that it may not be necessary to have a single definition because needs, values and resources vary by region.

- One way to gauge the value of public interest energy R&D projects is by the contribution made toward specific public policy goals, e.g., achieving affordable, clean, secure energy systems.

- The group generally believes that the public is largely unaware of public interest energy R&D, the potential needs for it, and how it differs from R&D that private companies undertake.

### *Governance of Public Interest Energy R&D*

The governance of public interest energy R&D should be tied closely to funding sources. This means that if public funds are used, then the public should be more involved in making decisions about R&D directions and priorities. For public input to be used, however, new mechanisms will be needed to determine public preferences.

One problem that could occur as a result of greater public participation in the R&D process is the potential for politicalization of R&D funding decisions. Politicization involves pressure from interest groups to earmark R&D funding to specific projects, often without regard to scientific or economic merit. Year-to-year funding variations tend to be more prevalent when funding is driven by political processes that are not necessarily sensitive to the technical requirements of research projects. Continuity of funding is often a critical success factor in R&D. Scientific and technical merit should be a guiding principle in R&D decision making. If greater public oversight of R&D occurs, mechanisms such as multi-year funding will be useful to ensure that longer-term R&D projects are seen through to completion.

Another important element of successful R&D governance is industry involvement. A balanced approach should weigh both public and industry input. The level of industry input should increase as the R&D project comes closer to commercialization. Industry input also is valuable in the early stages of R&D development.

The advisory processes currently used by EPRI and GRI are potential models for obtaining both industry and public involvement. If broader public involvement in public interest energy R&D becomes a goal, the approaches currently Used for obtaining public input may have to be revised. One approach would be to add breadth and depth to the public representation on the existing GRI and EPRI boards. The national laboratories offer a different model. They are not governed by advisory boards, but their R&D missions are, instead, tied to the missions of the Department of Energy, various energy legislation, and the annual appropriations bills of the U.S. Congress.

In restructured utility markets it may be necessary to create new institutions to oversee public interest energy R&D. However, it would be wasteful to create new institutions if the existing ones are capable of meeting the needs.

The following points summarize the group discussion of governance.

- The group believes that the oversight of public interest energy R&D should be closely tied to the source(s) of funding.

- A system of governance that overly politicizes the selection of R&D projects should be avoided.
- No matter what form of governance is used, input from industry about R&D needs, directions and priorities is very important.

- Although the public has not traditionally been heavily involved in public interest energy R&D decision making, new mechanisms for increasing this involvement should be considered.

- It is not clear that new organizations are needed to conduct public interest energy R&D but, if so, the new entities should take maximum advantage of the existing R&D infrastructure.

### *Funding of Public Interest Energy R&D*

New sources of funding for public interest energy R&D should be sought, including possible sources outside the electricity and natural gas utility Industries. Another way to expand the resource base is to identify nontraditional possibilities for R&D collaborations, thus leveraging both financial and technical resources. Although the government has a key role in funding public interest energy R&D, there are many possibilities for government involvement. The government could create a specific tax to fund public interest energy R&D, or provide specific tax credits and/or tax incentives to industry to encourage investment in public interest energy R&D.

The lack of public awareness about the costs and benefits of public interest R&D could be a problem in obtaining funding from government sources. Although the public appears to value the output of the research, there is general reluctance to initiate new taxes. Although the public should be more involved in R&D decision making, particularly if new taxes are involved, more effective public information and education should occur for the public to play a useful role.

In considering alternative sources of funding, an important aspect of the choice is the overall level of funding that might be needed. This could involve determining the level of unmet needs in the area of public interest energy R&D. There is a wide range of opinion about the level of unmet energy R&D needs. The group voted on this point and although a majority agreed that significant needs do exist, the vote was not unanimous. To clarify this issue, one approach might be to identify specific Public interest energy R&D programs (e.g., carbon mitigation and sequestration technologies, clean electricity generation and transportation fuels, energy efficiency technologies) and then determine how much public funding could be obtained.

In raising funds for public interest energy R&D, there are several funding alternatives other than taxes to consider. An electricity surcharge is one option. However, a separate surcharge could be viewed as a hidden tax. There are important implementation questions associated with a national electricity surcharge for public interest energy R&D. For example, if the funds are collected at the national level, how would they be allocated? It could be wasteful to create a new bureaucracy to allocate the funds. If the funds are distributed directly to the states, how would duplication of effort be avoided?

It could be possible for customers to play a more direct role in choosing and funding R&D programs. New Mexico, for example, is trying a customer check-off program to allow customers to choose the types of public interest programs they want to fund. A potential drawback with this approach is that it may not generate the level and consistency of funding that R&D programs usually need to be successful.

The following points summarize the group discussion of funding public interest energy R&D.

- It is important to find innovative ways to access previously untapped funding sources for public interest energy R&D from industry associations, trade groups, and other entities outside the electric and gas utility sectors.

- Government has a key role in funding public interest energy R&D, but there is no consensus on the specific scope of government involvement.

- It is worth considering novel mechanisms such as a customer check-off program to fund public interest energy R&D and raise general public awareness, but these approaches should be carefully evaluated.

- Before determining which funding mechanism to use, it would be valuable to define more specifically the unmet public interest energy R&D needs so that the public can be presented with a clearer picture of the R&D projects that warrant public funding.

## Breakout Session B

### *Definition of Public Interest Energy R&D*

Developing a consensus definition of public interest energy R&D may not be a useful exercise. In many instances a bright line does not exist to separate public and private energy R&D. Most projects have both private and public benefits. In fact, even the most obviously private energy R&D project can have substantial public benefits. Because there is a relatively small amount of funding available for public interest energy research and there are so many deserving projects, a precise definition may not be necessary for making good decisions. Energy R&D project priorities often can be determined without defining which projects are public interest and which are not. Selection decisions can be based on the magnitude of potential returns and the degree to which private funding is not available. On the other hand, having a definition of public interest energy R&D could be useful for educating policymakers and the general public about the relative merits of alternative government actions in support of public interest energy R&D.

One possible definition of public interest energy R&D includes those projects with sufficient common need but not enough competitive advantage to ensure that the projects will be undertaken. This is almost always the case for long-term, basic research, but is not always the case for technology demonstration projects. Because public interest energy R&D has broad public benefits that cannot be easily captured by private companies, there are likely to be chronic funding problems, even with government support.

Because government support is crucial to public interest energy R&D, the general public needs to better understand the costs and benefits. Traditionally, public education and involvement regarding energy R&D have not been a major priority in energy R&D decision making. Because restructuring of electric power markets is changing the familiar structure for electricity consumers (as well as for energy R&D decision making), perhaps there is need to enhance the effort to educate and involve the public in the policy process. For some of the larger public interest energy R&D projects being contemplated, such as those concerning greenhouse gas emissions, sufficient resource commitments may not be forthcoming without public support.

The following points summarize the group discussion of the definition of public interest energy R&D.

- There was some disagreement concerning the importance of creating a consensus definition of public interest energy R&D.

- There was general agreement that, if used, the definition of public interest energy R&D should focus on the fact that such projects have broad public benefits and are unlikely to be funded without government action.

- Many participants felt that, regardless of the precise definition, more effort needs to be made to demonstrate the benefits of Public interest energy R&D to the general public.

### *Funding of Public Interest Energy R&D*

*[Note: The participants in Breakout Session B agreed that funding mechanisms drive the creation of governance mechanisms and, thus, it would be more appropriate to discuss funding before governance during the session.]*

There should be a mix of funding sources. Although the U.S. Congress has an obligation to fund public interest energy R&D, additional funding sources should supplement this spending. Sources other than appropriations from the Congress could include:

- Voluntary industry funding including EPRI, GRI, and in-house industrial research,

- Voluntary consumer funding such as a check off on utility bills,

- Tax credits and incentives for collaborative research.

- A specific tax or surcharge on electricity and or natural gas by the states or the federal government.

Because there are difficulties with each of these approaches, it would be helpful to identify new and innovative ways to attract investment capital for public interest energy R&D.

There can be difficulties in using taxes to generate funding for public interest energy R&D. Although taxes probably are the most common mechanism for raising revenues for public purpose projects, there are political and technical barriers to consider. A very persuasive case would have to be made for the benefits of public interest energy R&D before a tax would be politically feasible. Technically, an increase in the use of distributed power systems could make implementation of a non-bypassable levy on power generation administratively difficult to implement. The difficulties encountered by GRI in seeking approval from the Federal Energy Regulatory Commission for a natural gas R&D funding mechanism provides a case study of the political and technical barriers that could be encountered if a similar undertaking were made for electricity.

Another aspect of funding for public interest energy R&D is the trade-offs among funding at the national, regional, state and local levels. Funding at the national level increases efficiency and avoids duplication of efforts among various regional and state programs. National funding would also be more effective for tapping global energy R&D initiatives and expertise.

However, there is also value in local projects that address local problems and use local resources. In many instances, state and local efforts can better address local needs and produce the tangible benefits necessary to generate support for funding from the general public. Public interest energy R&D currently is carried out on local, regional, and national levels, and there is no apparent reason why the restructuring of electricity markets would significantly alter the current mix. If anything, there could be greater need to enhance the coordination of local and national energy R&D programs to better leverage the available R&D funding, particularly if the level of funding is constrained.

The following points summarize the group discussion of R&D funding.

- The group generally thinks there should be a mix of funding sources for public interest energy R&D, in addition to continued appropriations by the U.S. Congress.

- There are many political and technical limitations to using specific taxes or electricity surcharges to fund Public interest energy R&D.

- There is a role for both state and federal funding, but these programs should be coordinated to avoid duplication of effort and to ensure the funds are leveraged to the maximum extent possible.

### *Governance of Public Interest Energy R&D*

The funding source(s) should drive governance structures. The group(s) responsible for funding the research should have the most input to how that research is carried out. If public funding is used, the research should be accountable to a diverse oversight board, including members of the general public, industry, research organizations, trade groups and low-income customer advocates, in addition to a technical review board.

The customer check-off system offers a direct way both to generate funds and foster a greater sense of public involvement in the technology development process. An example of this type of system would be a program in which customers choose to fund research in PhotoVoltaic technologies with benefits returned to the customers. Rather than fund specific projects, customers could choose to allocate research money to selected areas such as air or water protection. The check-off system, however, has never been tried and could create a “free rider” problem.

There are many challenges associated with creating and implementing initiatives to increase public purpose funding. The difficulties faced by the gas industry in its attempts to create an R&D funding mechanism that is acceptable to its diverse group of stakeholders illustrate the challenges that are inherently involved. Stakeholders in the gas industry have been reluctant to voluntarily participate in any mechanism perceived as a tax. Legislation probably is needed to secure public funding, but new laws that call for new taxes or surcharges will face severe political difficulties in being enacted.

It is probably necessary for the states to play a more active role in addressing public interest R&D. NARUC could play a more active role in efforts to shape the funding and governance

of public interest energy R&D. Specifically, a resolution should be prepared on the importance of continued funding for public interest energy R&D for consideration by the NARUC.

The following points summarize the group discussion of governance.

- There was significant agreement that the groups that fund public interest energy R&D should have the most input to how the funds are allocated.

- Substantial interest was voiced concerning the development of some type of voluntary check-off system, where customers would have a more personal stake in R&D by helping to determine where funds are allocated.

- NARUC needs to take a more active and visible role in helping to shape public purpose R&D funding and governance mechanisms.

## Breakout Session C

### *Definition of Public Interest Energy R&D*

Utility companies appear reticent to invest in public interest energy R&D due to competitive pressures and uncertainty about regulatory policies on restructuring. As a result, there is concern about the future of public interest energy R&D, especially if and when retail competition becomes a national reality, but also during the transition years as retail choice is unevenly implemented across the country. In addition to concerns about utility restructuring, the benefits of public interest energy R&D are generally difficult to capture, so that the general public, as well as utility investors, often are unaware of the value and benefits. While this fact justifies government support, it does not necessarily mean that utilities should continue their efforts. Market forces dictate that utilities should focus on enhancing their competitive advantage, which could mean government would shoulder a greater role in public interest energy R&D in the future.

In defining public interest energy R&D, there are several issues to consider. One is the level of funding needed to adequately support public interest energy R&D. There is a range of opinion about how much funding would be adequate to meet the needs. It will be difficult to develop a definition without greater agreement about the scope of the public interest energy R&D that needs to be accomplished. Another issue is that public interest energy R&D often is wrongfully considered an end in itself, rather than as a means of achieving public policy goals (e.g., improving the quality of the environment). Public interest energy R&D should be focused on social goals such as improving the quality of life and society. However, because R&D simultaneously serves both the public and private interests, there is no bright line distinguishing them.

However defined, public interest energy R&D should be thought of as R&D that has positive outcomes for the competitive environment, rather than only for the competitive market. This distinction clarifies the nature of this type of R&D, which serves the best interests of society at large.

The following points summarize the group discussion of the definition of public interest energy R&D.

- Public interest energy R&D, however defined, is valuable and should be continued because it supports broad public policy goals, such as improving living standards and enhancing the quality of life.

- Public interest energy R&D includes all socially beneficial projects that may not be supported within a competitive market structure.

### *Governance of Public Interest Energy R&D*

The most important issue in the governance and administration of public interest energy R&D is the importance of diversity, i.e., the inclusive involvement of a wide range of interest groups and stakeholder organizations. A diverse group of interests—including investors, customers, taxpayers (who may not be customers or investors of a particular utility/energy company), researchers, and consumers groups—should have input into the design and governance of Public interest energy R&D, and thus reflect the diversity of such R&D efforts. Existing R&D organizations—including the national laboratories, EPRI and GRI, universities, the Department of Energy, and others—should continue to sponsor and conduct public interest energy R&D.

Efforts to create and support new organizations to conduct, govern and administer public interest energy R&D probably would be unnecessary and duplicative. The existing organizations should be able to take on this responsibility as a coordination function. Because a highly effective infrastructure for R&D already exists, efforts to build on it, rather than to create something new with scarce resources, would be most effective. The existing R&D organizations should, however, be encouraged to coordinate their research programs more effectively than they currently do.

The existing R&D organizations should make greater effort to share the results of their public interest work with those who fund and are affected by it. Although many researchers and others within R&D organizations believe that research progress and results are fully shared with outside groups, oftentimes the results are known only to those within the research community. For public interest energy R&D to be fully supported by the diverse interests noted above, R&D results must be shared with a much wider audience, including the general public.

The following points summarize the group discussion of governance.

- Those who fund public interest energy R&D and benefit from it should have input into the public interest energy R&D agenda.

- Stability of research activities and organizations is important to the long-term success of Public interest energy R&D projects.

- The existing research infrastructure should be adapted to continue and encourage more collaboration among research organizations, while maintaining their diversity.

- Mechanisms should be identified for further collaborations that provide broader dissemination of benefits to those who fund research.

### *Funding of Public Interest Energy R&D*

There should be diversity in funding mechanisms to reflect the diversity of R&D partners that often support public interest activities. Scientific, government, industry and consumer interests must support public interest energy R&D. It is truly a national issue since *all* citizens of the United States receive benefits from energy research and development, particularly if it is assumed that public interest goals are achieved by higher energy efficiencies and lower utility rates. As a result, full public support for public interest energy R&D should be a goal of the policy development process.

Achieving full public support of public interest energy R&D is a lofty goal and presumes continued support by the federal government, including appropriations for the U.S. Department of Energy, the Environmental Protection Agency, and other federal research organizations. In fact, the US Congress continues to have a responsibility to finance a significant portion of public interest energy R&D, and other sources of financing cannot replace federal appropriations. The level of state-sponsored energy R&D varies widely throughout the country and probably cannot be counted upon to provide support much beyond current levels. If federal support were lessened for budgetary or other reasons, inconsistency in the level of funding from the states for public interest energy R&D is likely to create major gaps and thwart progress in solving important problems.

All taxpayers, in addition to utility investors and individual utility customers, are beneficiaries of public interest energy R&D. Thus, there is some justification for using a tax or a nonbypassable surcharge on all electricity or gas users for support of public interest energy R&D. However, it is critical that if such a charge is levied, it must be fair and mandatory so that all who benefit are charged equally. In particular, all public interest energy R&D funds collected from the public sector, through the use of a tax or surcharge on electricity or gas, must be clearly earmarked for R&D so that the funds are not considered a source of general revenue. Moreover, mechanisms for taxpayers to become more involved in public interest research—to have more of a stake in determining R&D projects—should be explored. Many ideas, such as a tax or utility bill check-off for public interest energy R&D, warrant more consideration.

Raising funds for public interest energy R&D during the transitional years before full retail competition might be more difficult than providing for financing when full retail competition is a reality. As a result, there is danger of a gap in financing public interest energy R&D during the transition period, and more federal support may be required as a result.

Because of the possibility of a larger government role in public interest energy R&D, more effort is need to better sell public interest energy R&D to those who will be asked, or required, to financially support it. The existing R&D organizations do not effectively educate the public about the benefits of R&D and, therefore, public support for it is not as strong as it could be. In the future, the existing R&D organizations may have to strengthen public involvement, so that all who are required to support public interest energy R&D have some knowledge of what it is and how they benefit from it.

The following points summarize the group discussion of funding.

- Diversity of funding mechanisms must reflect the many interests of the taxpayers, investors and ultimate users to support public interest energy R&D.
- Funding for public interest energy R&D must be fair, mandatory and non-bypassable.
- Money raised through taxes or surcharges should be earmarked, not sent to a general revenue fund.
- R&D institutions and the federal government should inform the public of the need for and benefits derived from public interest energy R&D.

# NARUC Resolutions

Among the utility regulatory participants at the dialog, there was sufficient consensus on the subject that NARUC participants brought a resolution of support to protect public purpose R&D to their national association. At its November 10-12, 1997, annual convention in Boston, NARUC unanimously adopted a *Resolution on Public Purpose Research and Development in the Electricity and Natural Gas Industries*. It is now NARUC policy that its committees are charged with continuing to seek solutions to the challenges of maintaining the benefits of public purpose energy research and development, based on a set of guiding principles. Exhibit 1 contains the text of this resolution.

A companion resolution addressing public purpose programs in the electric industry in general also was structured to explicitly encompass Public interest R&D in a manner consistent with the R&D resolution mentioned above. This resolution is shown in its unanimously passed form in Exhibit 2.

## Exhibit 1. NARUC Resolution on Research and Development

**Convention Floor Resolution No. 24—Resolution on Public Purpose Research and Development In the Electricity and Natural Gas Industries**

*WHEREAS, On February 26, 1997, NARUC resolved that, because beneficial public interest research and development may be at risk in restructured, more competitive energy Industries, it is timely to convene interested parties such as NARUC, NRRI, EPRI, GRI, DOE, NREL, electric and gas industry representatives, and others to discuss Public interest research and development; and*

*WHEREAS, On October 14-15, 1997, in St. Louis, Missouri, NARUC and others (NCCEI, ASERTTI, NRRI, EEI, EPRI, GRI, and DOE) sponsored the Executive Dialog on Public Purpose Research and Development in the Electric and Gas Utility Industries; and*

*WHEREAS, Participants in the Executive Dialog heard presentations from knowledgeable experts on:*

*"The Big Picture—R&D Trends in the US and Abroad,"*

*"Current R&D Landscape in the Electricity and Natural Gas Industries,"*

*"Benefits of Electricity and Natural Gas R&D," and*

*"Risks to R&D under Emerging Market Structures," and*

*WHEREAS, Participants at the Executive Dialog considered: "Strategic Options for Public Interest Energy R&D," by the National Council on Competition and the Electric Industry; and*

*WHEREAS, Participants at the Executive Dialog discussed:*

- *What is "Public interest" energy research and development? What are the issues that could interfere with the development of a consensus definition of what comprises Public interest R&D?*

- *What will be the best forms of governance for overseeing the conduct of this Public interest R&D?*

- *What will be the best mechanisms for funding this Public interest R&D? and*

*WHEREAS, The Executive Dialog produced some agreement and, where disagreement continues, a better understanding of the issues; there be it*

*RESOLVED, The National Council of Regulatory Utility Commissioners (NARUC), convened in its 109th Annual Convention at Boston, Massachusetts, charges its committees with continuing to seek solutions to the challenges of maintaining the benefits of public purpose energy research and development; and be it further*

*RESOLVED, NARUC supports ongoing collaborative efforts by EPRI, GRI and their constituents to develop new funding and governance mechanisms; and be it further*

*RESOLVED, These quests should be based on the following principles:*

- *The public receives important net benefits from public purpose research and development;*

- *Public purpose research and development should be better defined and communicated so the public will understand its benefits and costs and is relationship to public policy goals;*

- *Public purpose research and development should continue to be performed by institutions such as EPRI, GRI, the national labs, and other state-level and national-level entities;*

- *State and/or Federal governments should intervene in markets to the extent needed to continue public purpose research and development;*

- *Public purpose research and development should be administered by institutions with governance responsive and accountable to their funders;*

- *In addition to voluntary support, funding for public purpose research and development should be provided, to the extent needed, by some combination of mechanisms, perhaps including, but not limited to: taxes, tax credits, and/or non-bypassable system charges.*

## Exhibit 2. NARUC Resolution on Public Benefits Programs

**Convention Floor Resolution No. 23—Resolution Endorsing Federal Legislative Provisions to Preserve and Promote Public Benefits Programs in the Nation's Electric Industry**

*WHEREAS, State Commissions and legislatures, the Federal Energy Regulatory Commission (FERC) and the Congress are in the process of developing and implementing new policies to move the electric industry to reliance on greater competition in the marketplace: and*

*WHEREAS, For almost two decades, electric utilities across the United States have been making productive investments in energy efficiency, renewable energy, low-income service, and long-term research and development; and*

*WHEREAS, Energy efficiency investments have cost-effectively reduced the need for new generation by more than 40,000 megawatts, while helping to cut the energy requirements of appliances such as refrigerators and freezers by more than two thirds; and*

*WHEREAS, Hundreds of thousands of low-income household have received targeted energy assistance, and residential customers have been spared the threat of disconnection during periods of extreme heat and cold; and*

*WHEREAS, Utilities have helped a strong industrial base for delivering energy from wind, solar, biomass, and geothermal sources, creating the opportunity to diversify a power-plant fuel mix that is still fossil- and nuclear-dominated; and*

*WHEREAS, Spending on these programs has been dramatically curtailed in anticipation of increased competition in the electric industry; and*

*WHEREAS, The National Association of Regulatory Utility Commissioners (NARUC) adopted in November 1994 a Resolution on Competition, the Public interest, and Potentially Stranded Benefits which states "that a fundamental responsibility of state and federal electric utility regulators in this transition period is to assure that vital public interests and established public benefits will be preserved in any restructuring of the electric utility industry;" and*

*WHEREAS, NARUC adopted in July 1995 a resolution setting out "Principles to Guide the Restructuring of the Electric Industry " which states, among other things, that "The public benefits of energy efficiency, renewable resource technologies and research and development should be maintained through existing or new mechanisms;" and*

*WHEREAS, As Congress addresses restructuring policies, it is essential that the nation develop effective mechanisms for retaining and expanding these potentially "stranded benefits," and such mechanisms should not distort emerging competitive markets in electricity, nor should they erode states' traditional responsibilities for ensuring that electricity-related public benefits are widely and appropriately shared; and*

*WHEREAS, The nation has a compelling interest in preserving and promoting these public benefits, for the good of consumers, the economy, and the environment; and*

*WHEREAS, There are successful precedents in telecommunications regulation for State and Federal coordination in the delivery of public benefits associated with utility services; now, therefore, be it*

*RESOLVED, That the National Association of Regulatory Utility Commissioners (NARUC), convened at its 109th Annual Convention in Boston, Massachusetts, hereby urges Congress, as it considers legislation to restructure the nation's electric industry, to include in such legislation workable mechanisms to support State and utility public benefits programs such as energy efficiency, renewable energy technologies, research and development, and low-income assistance; and be it further*

*RESOLVED, That the design principles for such mechanisms should consider, among others:*

- *A Federal-State partnership, building upon state and utility expertise in designing and implementing electric service and public purpose programs, and leaving the greatest possible degree of flexibility and regulatory oversight to individual States;*
- *Such programs may be designed, supported, and delivered through the nation's electric system, using broad-based, competitively-neutral funding mechanisms, subject to regulatory oversight; and*
- *Federal support should be made available to assist and encourage the states to develop and implement public purpose programs that meet the needs of the States and the nation;*

*and be it further*

*RESOLVED, That NARUC will, under the direction of the Ad Hoc Committee on Restructuring and relevant standing committees, develop and present to NARUC's Executive Committee for its approval detailed recommendations, consistent with these design principles, on the mechanics, governance, funding levels, and rate elements of one or more mechanisms for delivering public benefits programs to consumers across the nation.*

# Appendix A. Agenda

## Tuesday, October 14, 1997

12:00 p.m.-1:30 p.m.
Welcoming Remarks

The Hon. Sheila Lumpe, Chair, Missouri PSC
The Hon. Bruce Ellsworth, New Hampshire PUC

**The Big Picture—R&D Trends in the U.S. and Abroad**

Robert Fri, Director, National Museum of Natural History, Smithsonian Institution

1:45 p.m.-3:15 p.m.
**Current R&D Landscape in the Electricity and Natural Gas Industries**

Moderator:
The Hon. Susan Clark, Florida PSC and Chair, NARUC Committee on Electricity

Speakers:
- Bob Shaw, Arete Corporation
- Steve Ban, GRI
- Bill Valentino, ASERTTI
- Kurt Yeager, EPRI

3:15-3:45
Break

3:45-4:45
**Benefits of Electricity and Natural Gas R&D and Risks to R&D Under Emerging Market Structures**

Moderator:
The Hon. Ruth Kretschmer, Commissioner, Illinois CC and Chair, NARUC Committee on Gas

Speakers:
- Jim Dooley, Pacific Northwest National Laboratory
- Leonard Hyman, Smith Barney
- Doug Jones, NRRI

4:45-5:15
**Introduction to Strategic Options**

Stephen Wiel, Executive Director, National Council on Competition and the Electric Industry

## Wednesday, October 15, 1997

8:30-10:40
Breakout Sessions

Professional facilitation by Energetics Incorporated

10:40 - 11:00
Break

11:00 - 12:00
**Reports from the Breakout Sessions and Closing Remarks**

Richard Scheer, Energetics Incorporated
The Hon. Bob Anderson, Commissioner, Montana PSC, and Chair, Executive Dialog Planning Committee

# Appendix B. Breakout Session Participants

## Breakout Session A

Larry Ambs, *Center for Energy Efficiency and Renewable Energy*
Bob Anderson, *Montana Public Service Commission*
Grieg Anderson, *Enron Portland General Electric*
Steve Ban, *Gas Research Institute*
Grant Brohard, *Pacific Gas & Electric Co.*
Jim Dooley, *Pacific Northwest National Lab*
Bruce B. Ellsworth, *New Hampshire Public Utilities Commission*
David Gausman, *Ohio Edison Co.*
Rich Hackner, *Energy Center of Wisconsin*
Mary Jo Huffman, *Indiana Utility Regulatory Commission*
Doug Jones, *National Regulatory Research Institute*
Duncan Kincheloe, *EPRI*
Jerry Lonergan, *Kansas Electric Utilities Research Program*
Steve Maxfood, *Missouri EIERA*
Al Pak, *EPRI*
Diane Pirkey, *US Department of Energy*
Beatriz Rivera, *New Mexico Public Utility Commission*
John Ruckes, *Connecticut Office of Policy and Management (SEO)*
Laska Schoenfelder, *South Dakota Public Utilities Commission*
Rick Smith, *Union Electric Co.*
Jim Sullivan, *Alabama Public Service Commission*
Virginia Takaki, *ComEd*
Ann Thompson, *NARUC*
Don Thornburgh, *Southern Co.*
Andy Varley, *American Electric Power*
Gunnar Walmet, *NYSERDA*
Stephen Wiel, *National Council on Competition and the Electric Industry*
Dan Zaneski, *ESEERCO*

Facilitators: Richard Scheer and Jennifer Bergman, *Energetics Incorporated*

## Breakout Session B

Keith Bissell, *Attorney*
Carl Blumstein, *University of California Energy Institute*
Jim Burg, *South Dakota Public Utilities Commission*
Bill Burnett, *GRI*
Jolynn Butler, *Public Utilities Commission of Ohio*
Michael Celinski, *Brooklyn Union*
Dave Dworzak, *EEI*
Renee Guild, *EPRI*
Roger Hamilton, *Oregon Public Utility Commission*

Mark Hanson, *Energy Center of Wisconsin*
Leonard Hyman, *Smith Barney*
Marshall Johnson, *Minnesota Public Utilities Commission*
Ruth Kretschmer, *Illinois Commerce Commission*
R.C. Loux, *Kansas Electric Utilities Research Program*
Jim Marean, *New York State Electric & Gas*
Fred McGuire, *Houston Industries*
Gary Nakakado, *NREL*
Jerry Ostroski, *Minnesota Power*
Miriam Pye, *ACEEE*
David Rohy, *California Energy Commission*
Art Rosenfeld, *US Department of Energy*
Gary Schmitz, *Colorado Public Utilities Commission*
Rudi Schoenfelder, *South Dakota Public Utilities Commission*
Wayne Shirley, *New Mexico Public Utility Commission*
Jack Siegel, *Energy Resources Institute*
Tony Stark, *Empire District Electric*
Cher Stuewe-Portnoff, *Missouri Department of Natural Resources*
Tina Thomas, *GRI*
Sue Tierney, *Economic Resource Group*
Robert Tindall, *FERC*
Peggy Welsh, *NARUC*
Jack White, *UTECH Inc.*

Facilitators: Joseph Badin and Jennifer Schilling, *Energetic Incorporated*

## Breakout Session C

Jon Biemer, *Bonneville Power Administration*
Dennis Capella, *PECO Energy*
Susan Clark, *Florida Public Service Commission*
Jason Cross, *Public Utilities Commission of Ohio*
Paul de Sa, *Harvard University*
Tom Grahame, *US Department of Energy*
Alex Hapka, *Kansas City Power & Light Co.*
Mark Hoffman, *Consortium for Energy Efficiency*
Douglas Horne, *Atlanta Gas Light Co.*
Renz Jennings, *Arizona Corporation Commission*
Judy Jones, *Public Utilities Commission of Ohio*
Marvin Lieberman, *Electric Power Research Institute*
John Neal, *National Rural Electric Cooperative Association*
Pam Nelson, *South Dakota Public Utilities Commission*
Graham Siegel, *Wisconsin Electric Power Co.*
Vence Smith, *Arkansas Public Service Commission*
Camie Swanson-Hull, *Indiana Utility Regulatory Commission*
Sharon Tahtinen, *Iowa Department of Natural Resources*
Phil Thompson, *University of Missouri-Rolla*

Bill Valentino, *NYSERDA*
Bill Washburn, *Missouri Public Service Commission*
Dan York, *Energy Center of Wisconsin*

Facilitators: Jeannette Brinch and Audrey Lamanna, *Energetics Incorporated*

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